CERTIFICATE OF VERIFICATION

I, Soo Jin KIM of 648-23 Yeoksam-dong, Gangnam-gu, Seoul, Republic of Korea state that the attached document is a true and complete translation to the best of my knowledge of the Korean-English language and that the writings contained in the following pages are correct English translation of the specification and claims of the Korean Patent Application No. 10-1999-0018896.

Dated this 30th day of January, 2007.

Signature of translator: ______________________

Soo Jin KIM

KOREAN INTELLECTUAL PROPERTY OFFICE

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Industrial Property Office.

Application Number : Patent Application No. 1999-18896

Date of Application : May 25, 1999

Applicant(s) : LG Electronics Inc.

COMMISIONER

[SPECIFICATION]

[TITLE OF THE INVENTION]

METHOD AND APPARATUS FOR RECORDING/REPRODUCING OF OPTICAL RECORDING MEDIUM

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 is a diagram showing an arrangement of a header preformatted at the beginning position of each sector in a general rewritable disc.

FIG. 2 is a block diagram showing a structure of an optical disc recording/reproducing apparatus for controlling defocus in accordance with the present invention.

FIG. 3 is an exemplary diagram showing an optical detector of the optical pickup shown in FIG. 2.

FIG. 4 is an exemplary graph showing tracking error signals detected at a header 1,2 field and a header 3,4 field depending on variation of a defocus offset.

FIGS. 5a to 5c are exemplary diagrams showing the level variation of tracking error signals detected at a header 1,2 field and a header 3,4 field depending on variation of a defocus offset.

Reference numerals of the essential parts in the drawings

201 : optical disc

202 : optical pickup

203 : error signal generator

204 : defocus detector

205 : servo controller

206 : focus operator

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]

The present invention relates to a high-density optical recording medium system, and more particularly, to an apparatus and method for recording/reproducing of optical recording medium, capable of detecting and compensating for defocus of the optical recording medium.

In general, a repetitively and freely rewritable optical recording medium, for example, an optical disc includes rewritable compact disc (CD-RW) and rewritable digital versatile disc (DVD-RW, DVD-RAM, DVD+RW).

These rewritable optical discs, particularly, DVD-RAMs have signal tracks made up of lands and grooves and enable the tracking control of an empty disc on which no information signal is written. Recently, information signals are also written on the tracks of lands and grooves so as to enhance recording density. For this purpose, the recent optical pickup for recording and

reproducing information signals uses the shorter wavelength of laser beam with an increased number of apertures formed in the object lens and thereby reduces the size of beam for recording/reproducing.

In order to achieve higher recording density, such a rewritable high-density optical disc is designed to have a reduced distance between the signal tracks, i.e., the smaller signal track pitch.

For the rewritable discs, it is naturally impossible to perform a disc control and a recording operation in an empty disc in which no information is written. Thus disc tracks are formed in lands and grooves to write information on, and control information for random access and rotation control is separately recorded in the disc, so as to enable tracking control in the empty disc.

The control information is, as shown in FIG. 1, written on the header pre-formatted at the beginning position of each sector, or along the track in the wobbling profile. The term "wobbling" as used herein refers to recording the control information on the boundary of tracks in accord to variation of laser beam by supplying power of laser diodes with information for modulating a predetermined clock and applying the modulated clock to the disc, e.g., information about a

desired position and the rotational speed of the disc.

The header preformatted at the beginning position of each sector includes four header fields (header 1 field, header 2 field, header 3 field and header 4 field). At this time, the four header fields are staggered with respect to each other from the track center. FIG. 1 shows an example of the header for the first sector in a track. Referring to FIG. 1, the track boundary of the user area in which data are actually written has a wobbling profile.

An optical record reproducing apparatus also performs focus controls with an optical pickup in recording and reproducing information.

In a case where the beam focus is deflected from the disc surface during a focus control, i.e., focus servo, which case will be referred to as "defocus" hereinafter, quality of data deteriorates in recording and reproducing the data and thereby the system operation becomes unstable.

The focus servo drives a focus actuator in the optical pickup to move the optical pickup up or down and make the beam in focus according to the turning and up-and-down motions of the optical disc. That is, the focus actuator drives the object lens for convergence of beam in the upward/downward direction, e.g., in a direction of the focus axis to maintain a constant distance between the object lens and the optical disc.

However, in the optical discs such as DVD-RAM where data can be written in both lands and grooves, the lands and grooves differ in the focus offset from each other due to a depth difference and cause defocus even when no focus error signal is detected.

That is, due to the depth difference between the lands and grooves, defocus may be detected in the tracks of the grooves even when the focus meets in the tracks of the lands. Likewise, defocus may be detected in the tracks of the lands even when the focus meets in the tracks of the grooves because of the depth difference between the land and grooves.

[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]

At the defocus status cannot be known only from the focus error signals in this case, jitter characteristic deteriorates and the bit error rate (BER) increases. Recording data in this state may result in change recording characteristics of lands and grooves and hence deterioration of data quality, which makes the system operation unstable.

Accordingly, the present invention is directed an apparatus and method for recording/reproducing of optical recording medium that substantially obviates one or more problems due to limitations and disadvantages of the

related art.

An object of the present invention is to provide an apparatus and method for recording/reproducing of optical recording medium, capable of detecting and compensating for defocus from header areas staggered with respect to each other.

[SYSTEM AND OPERATION OF THE INVENTION]

To achieve the above objects of the present invention, in an optical recording medium arranging a plurality of header areas being difference in phase as the non-writable areas for dividing shape of data area between writable data areas, a method for recording/reproducing of an optical recording medium includes the steps of: determining whether a tracking error signal detected from areas having different phase in the non-writable area is symmetric or not based on the reference level; deciding as "focus-on" if it is determined to be symmetric and deciding as defocus if it is determined to be asymmetric and outputting the resulting value; and performing a focus servo based on the resulting value.

The reference level is a tracking error signal detected from the data area.

The reference level is a track center of the tracking error signal.

The focus servo step performs a focus servo in order for two tracking error signals having different phases to be symmetric each other based on the reference level.

In an optical recording medium arranging a plurality of header areas being difference in phase as the non-writable areas for dividing shape of data area between writable data areas, a method for recording/reproducing of an optical disc includes the steps of: detecting level of a tracking error signal in the non-writable area; deciding as "focus-on" if the level of the tracking error signal exceeds the definite reference value and deciding as defocus if the level is below the definite reference value and outputting the resulting value; and performing a focus servo based on the resulting value.

The focus servo step performs a focus servo in order for the level of the tracking error signal to exceed the definite reference value.

In an optical recording medium arranging the 1 and 2 header areas being difference in phase for dividing shape of data area between writable data areas, an apparatus for recording/reproducing of an optical recording medium includes: a servo error generator for detecting tracking error signals from the 1 and 2 header areas, respectively, and outputting to the 1 and 2

tracking error signals; a defocus detector for detecting defocus by comparing a variation of the potential difference signal between the 1 potential difference between the 1 tracking error signal and the reference level and the 2 potential difference between the 2 tracking error signal and the reference level with the preset threshold value; and a focus servo for compensating defocus based on the resulting value of the defocus detector.

The defocus detector determines as defocus is occurred if the 1 potential difference and the 2 potential difference are asymmetric.

The defocus detector determined as defocus if the 1 potential difference is below the preset threshold when defocus is not occurred.

The defocus detector determined as defocus if the 2 potential difference is below the preset threshold when defocus is not occurred.

The defocus detector determined as "focus-on" if the 1 potential difference is in symmetric relation with the 2 potential difference, and the 1 and 2 potential differences exceeds the preset threshold, respectively.

The focus servo performs a focus servo so that the 1 potential difference is in symmetric relation with the 2 potential difference, and the 1 and 2 potential

differences exceeds the preset threshold, respectively.

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

The present invention is directed to detection and compensation of defocus using level difference between a reference level of a tracking error signal and a tracking error signal detected in each header field having different phase each other, in a system that a header is staggered on the basis of track sectors.

FIG. 2 is a block diagram showing the structure of an optical disc recording/reproducing apparatus for performing defocus control method according to the present invention, in which only the principal parts related to focus are shown.

Referring to FIG. 2, the optical disc recording/reproducing apparatus includes: a rewritable optical disc (201); an optical pickup (202) for recording/reproducing information on the optical disc (201); an error signal generator (203) for generating signals such as a RF signal (or a read channel 1) from electrical signals output from the optical pickup (202); a defocus detector (204) for detecting a magnitude and the direction of defocus by detecting a level of the tracking error signal outputted from the error signal generator

(203); a servo controller (205) for generating a focus driving signal from the magnitude and the direction of defocus detected from the defocus detector (204); and a focus driver (206) for controlling the optical pickup (202) based on the focus driving signal to compensate for the defocus.

Herein, the optical pickup (202) has a split photo detector for detecting the quantity of light and converting the detected quantity of light to electrical signals. The split photo detector can be divided, as shown in FIG. 3, into a predefined number of optical detecting elements, e.g., four optical detecting elements PDA, PDB, PDC and PDD in the signal track direction and the radial direction of the optical disc (201).

In the present invention as constructed above, the optical disc (201) has signal tracks made up of lands and grooves, and data can be recorded/reproduced on the tracks of both the lands and the grooves as well as either the land tracks or the groove tracks. Also, at the beginning position of each sector, header 1 and 2 fields and header 3 and 4 fields are staggered with respect to each other in a free format. That is, the phases of the header 1 and 2 fields are in inverse relation with those of the header 3 and 4 fields.

Thus, while setting the optical disc (201), or

during the recording/reproducing operation, the laser beam emitted from a laser diode of the optical pickup (202) is directed onto the signal tracks of the optical disc (201) and the beam reflected from the signal tracks of the optical disc (201) enters the split photo detector.

The split photo detector includes a plurality of optical detecting elements and outputs to the error signal generator (203) electrical signal proportional to the quantity of beam obtained from the respective optical detecting elements.

The optical detector, if constructed as shown in FIG. 3, outputs to the error signal generator (203) electrical signals a, b, c and d, each in proportion to the quantity of beam obtained from the respective optical detecting elements PDA, PDB, PDC and PDD.

The error signal generator (203) combines the electrical signals a, b, c and d to generate an RF signal necessary for data reading, and a read channel 2 signal and a focus error signal, which are all necessary for a servo control. The RF signal is obtained by combining the electrical signals a, b, c and d from the split optical detector as a+b+c+d, and the read channel 2 signal is obtained by combining the electrical signals as (a+d)-(b+c). The tracking error signal is obtained by processing the read channel 2 signal through filtering.

The split photo detector, if divided into two photodiodes (I1 and I2) in the direction of tracks, detects the RF signal (=I1+I2) and the read channel 2 signal (=I1-I2) from the beam quantity balance of both photodiodes. That is, in FIG. 3, a+d corresponds to I1 and b+c corresponds to I2.

The present invention also detects defocus using a level difference between tracking error signals detected at the header 1,2 field and the header 3,4 field staggered with respect to each other and a reference signal. The reference signal level is the center level of the tracking error signal detected at a user area.

For this, the tracking error (TE) signals among the servo error signals detected at the error signal generator (203) are input to the defocus detector (204).

After sampling the tracking error signals output from the header 1,2 field and the header 3,4 field, the defocus detector (204) detects the level difference between the tracking error signals and the reference signal.

The following Table 1 shows the tracking error signal levels under best conditions for generating servo error signals while controlling defocus and defocus in a state of tilt zero (i.e., mechanism 0), in which the tracking error signal levels change depending on variation

of a defocus offset at fixed tilt and detrack offsets.

[Table 1]

Defocus[ ]	Header 1,2[V]	Header 3,4[V]
00.00		
1.00		
2.00	1.50	1.70
3.00	1.50	2.70
4.08	2.20	3.30
5.00	2.30	3.70
6.00	2.10	3.70
7.00	1.60	3.10
8.00	1.10.	2.70
9.00		
10.00		

FIG. 4 is a graph illustrating Table 1, in which no defocus occurs when the potential difference between the tracking error signal detected at the header 1,2 field and the reference signal and the potential difference between the tracking error signal detected at the header field and the reference signal are the greatest.

That is, the tracking error signals are significantly shifted up and down in the header field. The level of tracking error signals is great when passing through the header 1,2 field and header 3,4 field if no defocus occurs, but the level of tracking error signals is small when passing through the header 1,2 field and header 3,4 field if defocus occurs.

Thus, a threshold value (Th1) is set in a state that the defocus is not occurred. Than, whether or not defocus has occurred can be determined by comparing the potential difference between the tracking error signal at the header 1,2 field and the reference signal (tracking error signal potential at header 1,2 field - reference potential =Vp1) with the predetermined threshold (Th1).

That is, if Vp1 ≥ Th1, it is determined the defocus is not occurred, i.e., "focus-on", whereas Vp1 < Th1, it is determined the defocus is occurred.

This can be applied to the header 3,4 field identically. That is, a threshold value (Th2) is set in a state that the defocus is not occurred. Than, whether or not defocus has occurred can be determined by comparing the potential difference between the tracking error signal at the header 3,4 field and the reference signal (tracking error signal potential at header 3,4 field - reference potential =Vp2) with the predetermined threshold (Th2). For example, if Vp2 ≥ Th2, it is determined the defocus is not occurred, i.e., "focus-on", whereas Vp2 < Th2, it is determined the defocus is occurred.

Meanwhile, whether or not defocus has occurred can be determined by comparing the potential difference between the tracking error signal at the header 1,2 field and the reference signal (tracking error signal potential

at header 1,2 field - reference potential = Vp1) with the potential difference between the tracking error signal at the header 3,4 field and the reference signal (tracking error signal potential at header 3,4 field - reference potential = Vp2).

FIGS. 5a to 5c are exemplary diagrams showing tracking error signals varying depending on variation of the defocus offset with tracking and focus on at tilt=0.

Referring FIGS. 5a to 5c, the left-hand signal is the tracking error signal V_{HD12} detected at the header 1,2 field, and the right-hand signal is the tracking error signal V_{HD34} detected at the header 3,4 field. A voltage V_{TE} detected at the center level of the tracking error signal at the user area is preferably the voltage of the reference level.

In a case where no defocus occurs, the potential difference between the tracking error signal at the header 1,2 field and the reference level ($Vp1=V_{HD12}-V_{TE}$) is almost equal to the potential difference between the tracking error signal at the header 3,4 field and the reference level ($Vp2=V_{HD34}-V_{TE}$), as shown in FIG. 5b. That is, the potential difference ($Vp1=V_{HD12}-V_{TE}$) is in symmetric relation with the potential difference ($Vp2=V_{HD34}-V_{TE}$).

This can be expressed by Equation 1.

[Equation 1]

$$V_{HD12} - V_{TE} \approx V_{HD34} - V_{TE}$$

$V_{HD12}-V_{TE} \geq Th1$,

$V_{HD34}-V_{TE} \geq Th2$

It is determined that defocus has occurred, when the potential difference Vp1 between the tracking error signal at the header 1,2 field and the reference level is in asymmetric relation with to the potential difference Vp2 between the tracking error signal at the header 3,4 field and the reference level, as shown in FIGS. 5a and 5c. Or, it is determined that defocus has occurred, when each potential difference is smaller than the Th1 or Th2.

This can be expressed by Equation 2.

[Equation 2]

$$V_{HD12} - V_{TE} \neq V_{HD34} - V_{TE} \quad \text{or,}$$

$V_{HD12}-V_{TE} < Th1$ or,

$V_{HD34}-V_{TE} < Th2$

As such, after calculation of the potential

difference Vp1 between the tracking error signal at the header 1,2 field and the reference level, and the potential difference Vp2 between the tracking error signal at the header 3,4 field and the reference level, the Vp1 is compared with the Vp2, as a result of which the magnitude of defocus are detected.

Thus, the focus detector (204) detects defocus in the above-described manner and outputs to the servo controller (205). If it is determined the defocus is occurred, the servo controller (205) generates a focus driving signal and outputs the focus driving signal to the focus driver (206) so that the potential difference between the tracking error signal at the header 1,2 field and the reference level ($Vp1=V_{HD12}-V_{TE}$) is in symmetric relation with the potential difference between the tracking error signal at the header 3,4 field and the reference level ($Vp2=V_{HD34}-V_{TE}$), and each potential difference is equal to the threshold (Th1 and Th2).

The focus driver (206) drives a focus actuator in the optical pickup based on the focus driving signal so that the object lens is separated from the optical disc at a constant distance.

The present invention presets the thresholds and reduces time required for detecting and compensating defocus during an actual data writing operation, thereby

enabling a real time writing operation through rapid stabilization of focus servo.

[EFFECT OF THE INVENTION]

As described above, according to an apparatus and method for recording/reproducing of optical recording medium, since the level of a tracking error signal detected in a header field staged with respect to each other from a track center varies in accord with defocus offset, by using this characteristic, defocus is detected and compensated from variation of the tracking error signal during recording/reproducing actual data, thereby preventing deterioration of data quality caused by defocus during a recording/reproducing operation, enabling a real time writing operation through rapid stabilization of focus servo, and operating the system stably.

It will be apparent to those skilled in the art than various modifications and variations can be made in the present invention.

Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is :

1. In an optical recording medium arranging a plurality of header areas being difference in phase as the non-writable areas for dividing shape of data area between writable data areas,

a method for recording/reproducing of an optical recording medium including the steps of:

determining whether a tracking error signal detected from areas having different phase in the non-writable area is symmetric or not based on the reference level;

deciding as "focus-on" if it is determined to be symmetric and deciding as defocus if it is determined to be asymmetric and outputting the resulting value; and

performing a focus servo based on the resulting value.

2. A method for recording/reproducing of an optical recording medium as claimed in claim 1, wherein the reference level is a tracking error signal detected from the data area.

3. Deleted

4. A method for recording/reproducing of an optical

recording medium as claimed in claim 1, wherein the focus servo step performs a focus servo in order for two tracking error signals detected from areas having different phases to be symmetric each other based on the reference level.

5. In an optical recording medium arranging a plurality of header areas being difference in phase as the non-writable areas for dividing shape of data area between writable data areas,

a method for recording/reproducing of an optical disc including the steps of:

detecting level of a tracking error signal in the non-writable area;

deciding as "focus-on" if the level of the tracking error signal exceeds the definite reference value and deciding as defocus if the level is below the definite reference value and outputting the resulting value; and

performing a focus servo based on the resulting value.

6. A method for recording/reproducing of an optical recording medium as claimed in claim 5, wherein the focus servo step performs a focus servo in order for the level

of the tracking error signal to exceed the definite reference value.

7. A method for recording/reproducing of an optical recording medium as claimed in claim 5, wherein the tracking error signal level detecting step detects the potential difference between potential of tracking error signal detected in the non-writable area and the reference level as a level of the tracking error signal.

8. A method for recording/reproducing of an optical recording medium as claimed in claim 7, wherein the reference level is a tracking error signal detected from the data area.

9. A method for recording/reproducing of an optical recording medium as claimed in claim 5, wherein the tracking error signal level detecting step detects a level of a tracking error signal in any one non-writable area among the plurality of non-writable areas.

10. In an optical recording medium arranging a plurality of header areas being difference in phase as the non-writable areas for dividing shape of data area between writable data areas,

a method for recording/reproducing of an optical disc including the steps of:

obtaining 1 potential difference between a tracking error signal detected in the 1 header area;

obtaining 2 potential difference between a tracking error signal detected in the 2 header area; and

detecting defocus by comparing the variation value of the 1 and 2 potential differences obtained at the above steps and the preset threshold and outputting the resulting value.

11. A method for recording/reproducing of an optical recording medium as claimed in claim 10, wherein the reference level is a tracking error signal detected from the data area.

12. A method for recording/reproducing of an optical recording medium as claimed in claim 10, wherein the defocus detecting step determines as defocus if the difference value between the 1 potential difference and the 2 potential difference exceeds the preset 1 threshold value.

13. A method for recording/reproducing of an optical recording medium as claimed in claim 12, wherein

the focus servo step performs a focus servo in order for the difference value between the 1 potential difference and the 2 potential difference to be below the preset 1 threshold value.

14. A method for recording/reproducing of an optical recording medium as claimed in claim 10, wherein the defocus detecting step determines as defocus if the 1 potential difference is below the preset 2 threshold value when defocus is not occurred.

15. A method for recording/reproducing of an optical recording medium as claimed in claim 14, wherein the focus servo step performs a focus servo in order for the 1 potential difference to exceed the 2 threshold value.

16. A method for recording/reproducing of an optical recording medium as claimed in claim 10, wherein the defocus detecting step determines as defocus if the 2 potential difference is below the preset 3 threshold value when defocus is not occurred.

17. A method for recording/reproducing of an optical recording medium as claimed in claim 16, wherein the focus servo step performs a focus servo in order for

the 2 potential difference to exceed the 3 threshold value.

18. A method for recording/reproducing of an optical recording medium as claimed in claim 10, wherein the defocus detecting step determines as "focus-on" if the 1 potential difference is in symmetric relation with the 2 potential difference, and the 1,2 potential differences exceed the preset 2,3 threshold, respectively.

19. A method for recording/reproducing of an optical recording medium as claimed in claim 18, wherein the focus servo step performs a focus servo so that the 1 potential difference is in symmetric relation with the 2 potential difference, and the 1,2 potential differences exceed the preset 2,3 threshold, respectively.

20. In an optical recording medium arranging a plurality of header areas being difference in phase as the non-writable areas for dividing shape of data area between writable data areas,

an apparatus for recording/reproducing of an optical disc comprising:

a servo error generator for detecting tracking error signals from the 1 and 2 header areas, respectively, and outputting to the 1 and 2 tracking error signals;

a defocus detector for detecting defocus by comparing a variation of the potential difference signal between the 1 potential difference between the 1 tracking error signal and the reference level and the 2 potential difference between the 2 tracking error signal and the reference level with the preset threshold value; and

a focus servo for compensating defocus based on the resulting value of the defocus detector.

21. An apparatus for recording/reproducing of an optical recording medium as claimed in claim 20, wherein the reference level of the defocus detector is a tracking error signal detected from the data area.

22. An apparatus for recording/reproducing of an optical recording medium as claimed in claim 20, wherein the defocus detector determines as defocus if the 1 potential difference is in asymmetric relation with the 2 potential difference.

23. An apparatus for recording/reproducing of an optical recording medium as claimed in claim 20, wherein the defocus detector determines as defocus if the 1 potential difference is below the preset threshold value when defocus is not occurred.

24. An apparatus for recording/reproducing of an optical recording medium as claimed in claim 20, wherein the defocus detector determines as defocus if the 2 potential difference is below the preset threshold value when defocus is not occurred.

25. An apparatus for recording/reproducing of an optical recording medium as claimed in claim 20, wherein the defocus detector determines as "focus-on" if the 1 potential difference is in symmetric relation with the 2 potential difference, and the 1,2 potential differences exceed the preset threshold, respectively.

26. An apparatus for recording/reproducing of an optical recording medium as claimed in claim 20, wherein the focus servo performs a focus servo so that the 1 potential difference is in symmetric relation with the 2 potential difference, and the 1,2 potential differences exceed the preset threshold, respectively.

27. In an optical recording medium arranging a plurality of non-writable areas being difference in phase between writable data areas,

a method for recording/reproducing of an optical disc including the steps of:

detecting a tracking error signal from area having different phase in the non-writable areas;

confirming defocus in the tracking error signal; and

performing a focus servo if the defocus is confirmed.

28. A method for recording/reproducing of an optical recording medium as claimed in claim 27, wherein the defocus confirming step determines whether the detected tracking error signal is symmetric based on the reference level.

29. A method for recording/reproducing of an optical recording medium as claimed in claim 28, wherein the defocus confirming step determines as "focus-on" if the detecting tracking error signal is determined to be symmetric to the reference level, and as defocus if determined to be asymmetric to the reference level.

30. In an optical recording medium arranging a plurality of non-writable areas being difference in phase between writable data areas,

a method for recording/reproducing of an optical disc including the steps of:

detecting level of a tracking error signal in the non-writable area;

deciding as defocus by comparing the level of the tracking error signal with the preset definite reference value; and

performing a focus servo if determined as defocus.

31. A method for recording/reproducing of an optical recording medium as claimed in claim 30, wherein the defocus deciding step determines as "focus-on" if the level of the tracking error signal exceed the preset definite reference value and as defocus if the level is below the preset definite reference value.

[ABSTRACT OF THE DISCLOSURE]

[ABSTRACT]

The present invention relates to an apparatus and method for recording/reproducing of optical recording medium. Since the level of a tracking error signal detected in a header field staged with respect to each other from a track center varies in accord with defocus offset, by using this characteristic, defocus is detected and compensated from variation of the tracking error signal during recording/reproducing actual data, thereby preventing deterioration of data quality caused by defocus during a recording/reproducing operation, enabling a real time writing operation through rapid stabilization of focus servo, and operating the system stably.

[TYPICAL DRAWING]

FIG. 2

[INDEX WORDS]

defocus, tracking error

FIG. 1

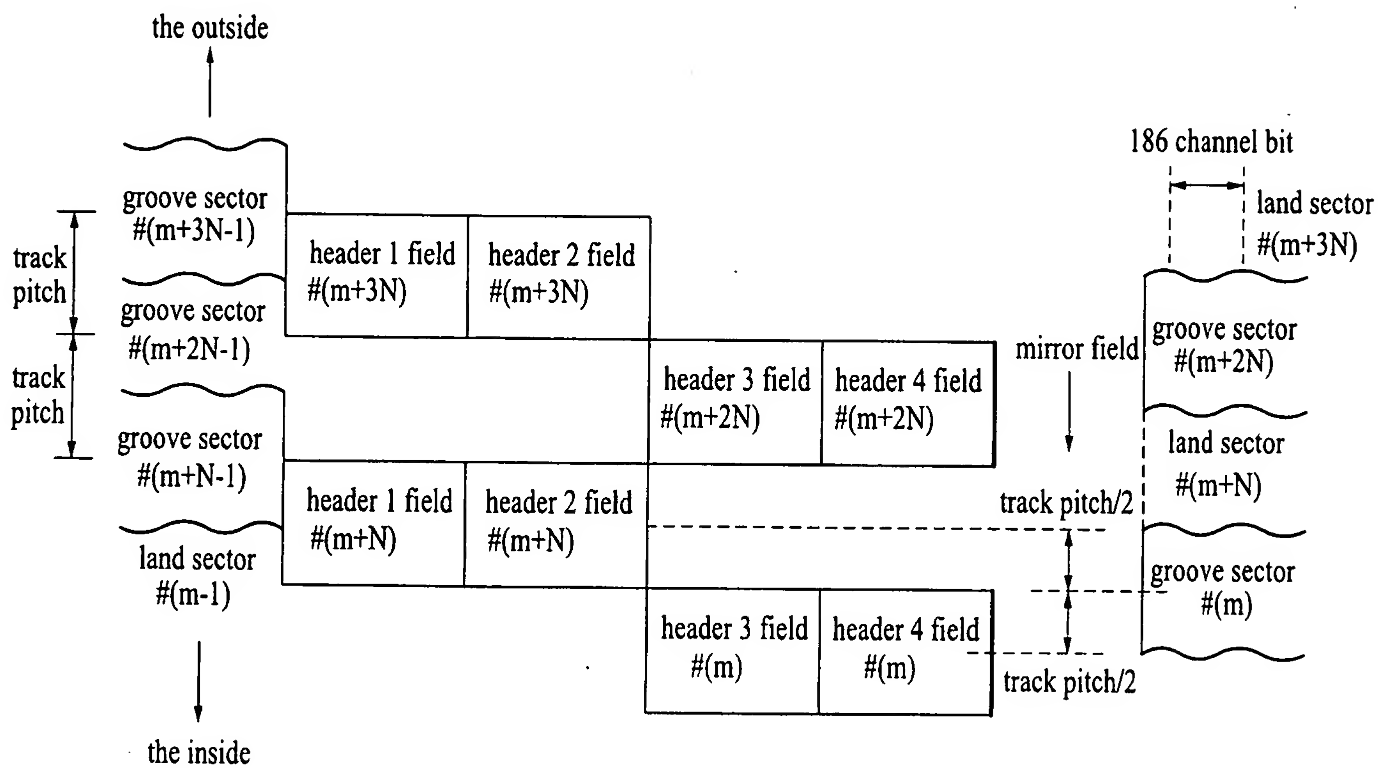

the outside
groove sector
#(m+3N-1)
track
pitch
groove sector
#(m+2N-1)
track
pitch
groove sector
#(m+N-1)
land sector
#(m-1)
the inside
header 1 field
#(m+3N)
header 2 field
#(m+3N)
header 3 field
#(m+2N)
header 4 field
#(m+2N)
header 1 field
#(m+N)
header 2 field
#(m+N)
header 3 field
#(m)
header 4 field
#(m)
mirror field
track pitch/2
track pitch/2
186 channel bit
land sector
#(m+3N)
groove sector
#(m+2N)
land sector
#(m+N)
groove sector
#(m)

FIG. 2

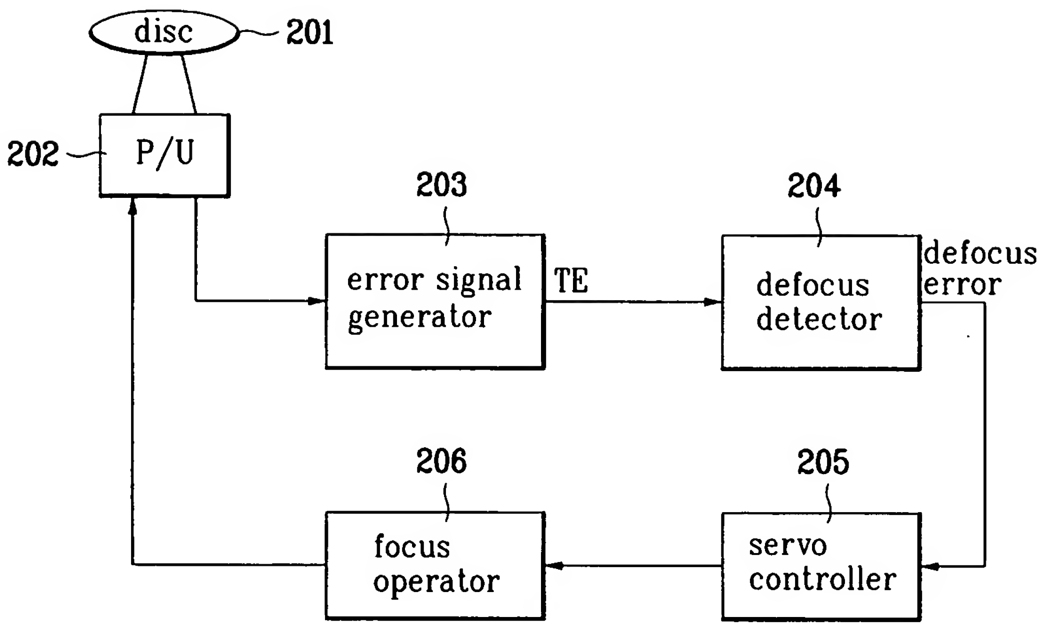

disc
201
202
P/U
203
error signal generator
TE
204
defocus detector
defocus error
206
focus operator
205
servo controller

FIG. 3

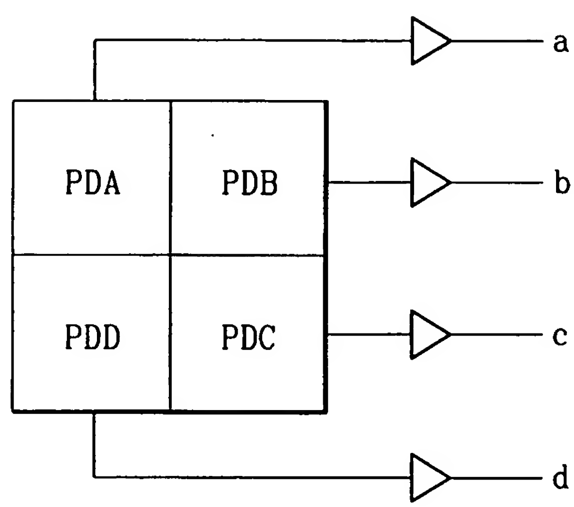

PDA
PDB
PDD
PDC
a
b
c
d

FIG. 4

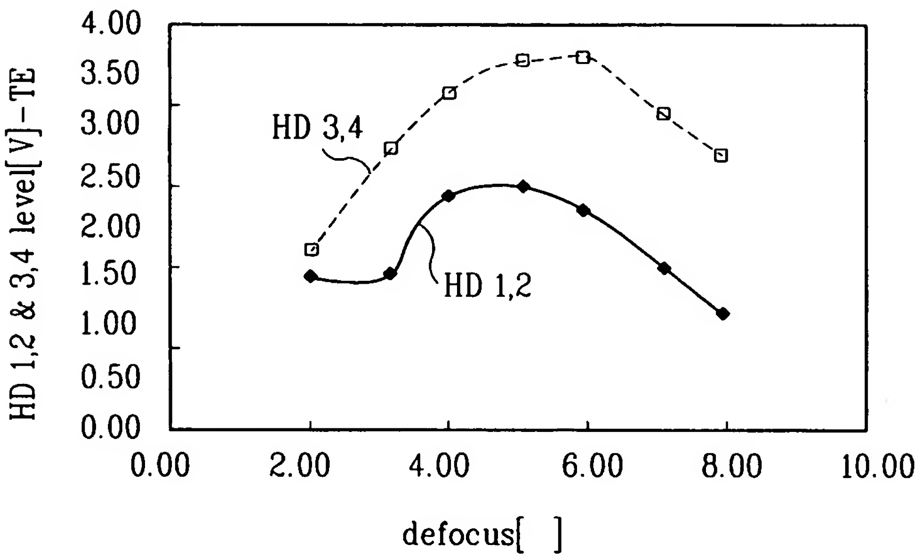
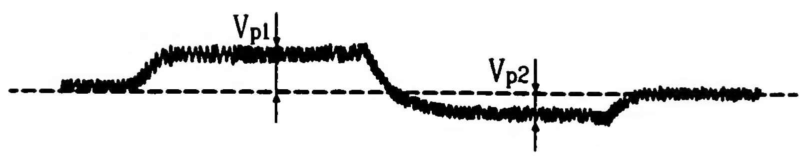
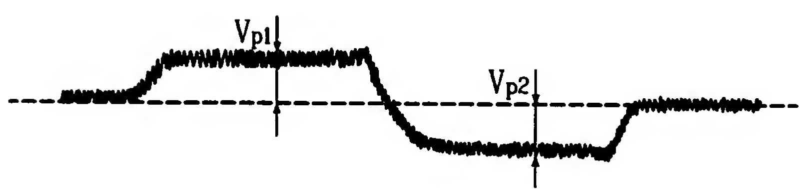

HD 1,2 & 3,4 level[V]-TE
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
HD 3,4
HD 1,2
0.00
2.00
4.00
6.00
8.00
10.00
defocus[ ]

FIG. 5a



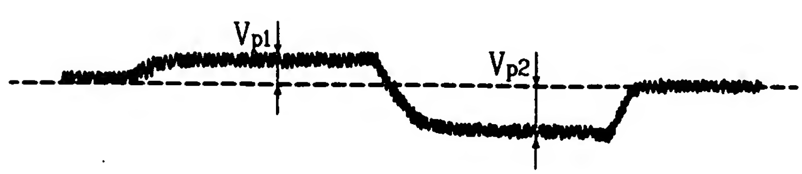
tilt=0, detrack offset=4.97
defocus offset=2.0

FIG. 5b



tilt=0, detrack offset=4.97
defocus offset=4.8

FIG. 5c



tilt=0, detrack offset=4.97
defocus offset=8.0